PRODUCTION AND DEHYDRATION OBSERVATION TOUR

U.S.A./LONDON

10 March - 30 March, 1990

TRIP REPORT

COMMERCIAL AGRICULTURE PRODUCTION AND MARKETING PROJECT

Chemonics International Consulting Division in Cooperation with

The Swaziland Ministries of:

Agriculture and Cooperatives,

Commerce, Industry and Tourism,

Education, and

Finance

and the United States Agency for International Development

Mbabane, Swaziland

April 1990

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MEMORANDUM

TO: See Distribution List

FROM: Kimball M. Kennedy, III
Chief of Party, CAPM

DATE: May 25, 1990

SUBJECT: Production and Dehydration Observation Tour Report
London/USA, March 1990

Attached please find a copy of the Production and Dehydration Observation Tour Report. CAPM is pleased to have organized this programme and believes that it will contribute to the commercialization of agriculture in Swaziland.

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SECTION I

EXECUTIVE SUMMARY

A. Introduction

The purpose of the Commercial Agricultural Production and Marketing (CAPM) Production and Dehydration Observation Tour was threefold: 1) to acquaint tour participants with current production methods for fresh fruits and the production and dehydration methods for vegetables and spices, 2) to view current processing technologies and equipment in operation in the UK and USA, and 3) to study the market demands for dehydrated goods on an international scale. The 20 day trip was divided into 4 related segments and included meetings with equipment suppliers, corporate tours, which provided an overview of the fresh and dried food industry, tours through fruit and vegetable production and marketing research institutes and commercial orchards, and visits with several consulting firms.

Detailed information on equipment, technologies, marketing of final products, current research findings and industry standards was obtained. Tour members included a cross-section of Swaziland's agricultural production and marketing sector: private sector Swazi farmers, business persons and government officers.

B. Equipment Suppliers

Meetings with equipment suppliers included APV Company and Neu Engineering. These companies each manufacture dehydration equipment. The APV line consists of two basic designs: continuous, and tunnel tray type. The company customizes its standard design to suit its buyers' needs and manufactures customized dehydration equipment. The Neu Company specializes in pneumatic equipment for the transfer of dried products and manufactures custom orders only.

C. Production and Dehydration Industries

The observation tour included visits to three top fruit and vegetable processing and shipping companies in the US: Beatrice/Hunt-Wesson, McCormick Spice Company, and the JR Brooks Company.

Beatrice/Hunt-Wesson Company is the largest tomato processing company in the world. The factory in Davis, California processes 318,000 mt of tomatoes annually, using a fully automated and continuous operation. Tomato concentrate is stored in bulk and reconstituted throughout the year into a variety of tomato-based products depending on market demand.

McCormick Spice Company in Hunt Valley, Maryland, is the largest spice processing company in the world. It processes and markets a wide variety of dried spices, herbs and vegetables. McCormick's major spice product is black pepper and main vegetable products are onions and garlic. McCormick also processes turmeric; an analysis on a Swaziland sample found its quality to be well above average, based on company standards.

The JR Brooks Company, located near Homestead, Florida, is the largest packer and shipper of fresh tropical fruit and vegetables in the US. The company packs and ships over 20 different products sourced from a wide variety of supplier/producers. The average producer cultivates between 3-4 h, but the company receives and buys fruit from growers who own but one fruit bearing tree. The packing house has two lines; one which is fully automated and computerized and of high through put which processes limes and avocados, and a smaller manual line which handles all other products.

A trip to Northrup King Seed Company, Gilroy CA Sales Office, was planned, but had to be cancelled due to time restrictions. However, the company's address was obtained as a future contact and supplier of vegetable seeds which may be of value to Swaziland farmers.

D. <u>Research</u>

Overseas Development Natural Resource Institute - London, England
Food Sciences & Technology Dept. - University of California
Tropical Center for Agriculture and Education - University of Florida

An extensive tour of Overseas Development Natural Resource Institute (ODNRI) was arranged: the group walked through laboratories for spice research, fruit and vegetable post harvest technologies, and learned about the economic and marketing procedures which were observed in operation. ODNRI is able to provide technical assistance to institutions within governments through direct contract or through Government to Government agreement. This technical arm of the UK Ministry of Overseas Development provided free analysis of a tumeric sample grown in Swaziland.

Representatives of the Food Science and Technology Department, University of California at Davis, provided tour members with a comprehensive technical background on fruit and vegetable dehydration. The importance of maintaining high standards for raw materials in order to ensure a quality final product was stressed. The Department also provided technical

specifications for dehydration equipment which would be suitable for use in Swaziland. Continuing contact with individuals working in Swaziland's agricultural sector was encouraged by the staff of the department.

In California, it was about one month too early to observe extensive fruit and vegetable production. However, visits were made to production areas and tour members were able to survey field layout for products such as tomatoes, rice, asparagus, peaches, plums, and some production of garlic and spinach. Detailed discussions were held with Mr. Kenneth Calhoun, the District Manager of Field Operations for Hunt Foods. Two vegetable products, tomatoes and a special variety of maize developed for popcorn, are among the company's main products.

The Tropical Center for Agricultural Research and Education at the University of Florida at Homestead, provided significant insight into specialized fruit/vegetable production. Information included research on guava production and other tropical fruits, as well as conventional vegetables such as tomatoes, french beans and okra, all potential high value crops in Swaziland. Orchard culture and irrigation practices were demonstrated. Small scale production units which are common in Florida, were of special interest to tour members as they were seen to have been potential application in Swaziland.

E. Consulting Firms

Meetings with representatives of the consulting organizations, [illegible] x Dehydration Consultants, and ABV Dehydrated Products Brokerage, were arranged by the CAPM subcontracted firm, High Value Horticulture. These individuals provided detailed information on dehydrated products, quality standards, technology, marketing, packaging and prices. These consulting firms are available to CAPM when required, and can provide assistance on the market-driven objectives of the project. The project intends to have representatives from HVH visit Swaziland in the next few months to further explore the options.

PRODUCTION AND DEHYDRATION OBSERVATION TOUR

U.S.A. AND LONDON

SECTION II : VISITS

A. Introduction

The purpose of the tour was to acquaint private sector Swazi farmers, business persons and government officers with the production and dehydration methods for fruits, vegetables and spices, current processing technologies and equipment, and international market demands for dehydrated goods. The tour included visits to a research and production station for guavas at the University of Florida as well as visits to commercial orchards.

The tour was composed of the following participants:
Patrick Lukhele, Director of Agriculture, MOAC;
Absolam Dlamini, Assistant Commissioner of Cooperatives, MOAC;
Thembayena Dlamini, Senior Officer, Planning, MCIT;
Spencer Dlamini, Field Manager, Tibiyo;
Eric Muzi Dlamini, private farmer;
Chris Vickery, private farmer and partner in Swazi Spice Works
James Bunnell, CAPM Agribusiness Specialist.

B. Manzini/Johannesburg

During the four-hour layover at Jan Smuts airport, the group discussed the objectives and goals of the tour and how findings of interest might be implemented in Swaziland.

Chris Vickery and Patrick Lukhele brought up the need for more contact and cooperation between the private sector farming community and MOAC, especially in the areas of research, extension and training. Chris also brought up an idea which the group fully endorsed; for the MOAC to organize a farming or production competition for increasing maize yield in Swaziland.

The competition would be sponsored by MOAC and open to all Swazi farmers. Each participant would select a plot (10m x 10m), measured and numbered by an MOAC official. Each participant would choose his/her own planting and growing methods including seed, fertilizer, pest control, use of water, weed control, etc. No subsidies would be provided. MOAC extension officers would monitor and advise. At a pre-determined date, the extension officer would visit each participant, and with a mobile thrasher, thrash each participant's sample plot, and weigh and record the results. MOAC would award winners (prizes could be donated by

direct beneficiaries such as seed suppliers, maize millers, fertilizer companies, etc.). First prize could be a baakie. Other prizes could be mechanical weeders, pumps and supplies of fertilizer. In all cases, each participant who completed the competition would be given a badge of honour.

Throughout the competition, extensive publicity would be given by radio, TV and newspapers. Winners would be interviewed and could explain their production methods and innovations. The competition would require a significant amount of detailed planning by MOAC officials, and the possibility of proceeding with the plan would be investigated on return to Swaziland.

C. London

1. High Value Horticulture

In London, the group's first meeting was with Mr. Denzil Phillips, Director of High Value Horticulture (HVH) and Ms. Mary Butler, his secretary. The first technical meeting was with Mr. Richard Wells, HVH consultant on dehydration.

Mr. Wells' presentation provided a thorough background of the dehydration industry, and pointed out products such as carrots, potatoes and other root crops that would not be a sound venture for Swaziland as they were highly mechanized crops and promoting their production in Swaziland would have no comparative production or market advantage. Dehydration of root crops represent high capital cost, installations that run at rates of 4-5 mt/hr. Mr. Wells believed that, depending upon labor, Swaziland should concentrate its agricultural production efforts on more high value crops, depending upon labor, such as chilies, leeks, parsley, tomatoes, spices and herbs. Turmeric is in growing demand in the food processing industry because it is used both as a condiment and colorant.

Mr. Wells stressed the importance of effective monitoring practices, maintaining high sanitation standards, quality assurance methods, and producing end products of conformity which are microbiologically safe.

Chris Vickery explained about the products grown in Swaziland and requested information on the types of driers which would be appropriate for use in dehydrating these products. The primary need for driers is for the turmeric operation, of about 2 mt per day with the flexibility to dehydrate other local crops. Tour members discussed the benefits of continuous belt driers versus manually operated tunnel driers using trays. Mr. Wells offered "sophisticated" system alternatives such as multi-belt and stacked driers, and discussed the degree of automatic control, minimum measuring, and control of temperature and relative humidity requirements of these driers.

Cost comparisons for driers at a 2 mt/day (dry) capacity output would be:

Tunnel-tray drier from US $68,000-$175,000.
Continuous drier (belt) US $430,000 (minimum).

These figures do not include product preparation, heat source (boiler), or packaging equipment.

Mid morning discussions followed with Mr. M.D. Wright, Sales Engineer for APV Pasilac Limited, on dehydration equipment in general, and the specific equipment manufactured by APV. Mr. Wright felt that the continuous (belt band) driers were too expensive for Swaziland's needs, but, he said that APV could design a tunnel-tray drier of 6-12 trucks appropriate for use in Swaziland, from US$70,000 to US$176,000. This would include zoning (3 or 4 zones of different temperatures in different stages). Again, this would not include the capital needed for product preparation, heating or packaging. The trucks and trays would be made of 316 stainless steel and would represent approximately 40% of the cost of the drier.

The discussion then moved to the idea of having 2 or 3 small driers in series. This idea was interesting because it was flexible; the driers could be used as zones for a single product (turmeric for example), or could be used for an overlapping commodity, such as parsley, without disrupting the main operation.

Another subject which which was raised focused on experimentation and mobility. This was discussed within the framework of Swaziland's need to have food technology research and development capabilities, and the need to carry out production and marketing trials in different parts of the country on different products. Mr. Wright believed that a drying unit handling 50-150 kg/day (wet basis) with a full range of temperature and relative humidity control and variable air speed, could be acquired for about US $3,000-4,000.

Mr. Wells said the mobile unit he took to Lesotho for asparagus drying could process (14 kg wet) 1.25 kg dry output/hr. This drier processed peelings which are rather dry to begin with.

Mr. Wright said the APV Company could carry out a turmeric drying trial at their pilot plant in Carlisle, in the United Kingdom. They would require about 10 kgs of the product to begin testing.

The last discussion focused on product packaging. It was emphasized that products should be packaged in heat-sealed polyethylene wrap and packed in fiberboard cartons. The product should be stored at below 10 degree centigrade; assuming Swaziland conditions, this would require cold storage.

2. Neu Engineering

During the afternoon, the group visited Neu Engineering Ltd. and discussions were held with Mr. Michael Holcombe, Southern Area Sales Manager and Mr. Ray Cole, the development engineer.

Neu Engineering is the UK subsidiary of a French engineering group. The UK group deals primarily with pneumatic systems of product transport. The French parent company handles the dehydration equipment division and manufactures all types of such equipment. All units are custo' built; there are no standard models. Their design ensures that no cross contamination of product on changeovers occurs. Mr. Holcombe kindly agreed to send brochures to CAPM, including the cost of a pilot plant with a 50 kg-150 kg capacity. He informed the group that Neu Engineering often starts with a pilot scheme and after trials will upgrade, discounting the initial cost to the buyer in favor of the operational plant.

On March 13, the group had two meetings, one in the morning at the Overseas Development Natural Resource Institute (ODNRI), and the other in the afternoon at High Value Horticulture offices.

3. Overseas Development Natural Resources Institute

Mr. John Nabney, Deputy Director at ODNRI, gave a brief introduction to the ODNRI. He said that ODNRI is a British agency responsible for overseas technical work, particularly post-harvest programs. ODNRI operates a number of programs in a variety of locations and consequently, expects to become an executive agency for the British Overseas Development Agency (ODA).

Mr. Nabney told the group that currently ODNRI is funded on a program basis, which means that research funds are granted only after the ODA approves a program strategy. Other funding sources include: (1) pool funding; and (2) contract funds from international organizations (such as the World Bank, FAO and USAID) and the private sector.

Mr. Nabney explained that ODNRI specializes in three areas of research; post-harvest, land use (cropping) and pest control processes. Most of the research activities are funded by ODA.

When ODNRI lacks technical personnel to complete a project, they subcontract with universities, institutes and the private sector within the UK to undertake the research. The group was shown a video of ODNRI-supported projects in developing countries.

The group then met with Mr. Alan Marter, an economist with the Department of Economics and Social Statistics, who explained that his department offers economic and social statistics training courses and in-country training. In addition to keeping statistics on marketing trends, the department assesses both the economic and financial viability of proposed or desired projects. It also provides consultants (technical assistants) who work with a project from beginning production to locating a market. Mr. Marter explained that in assessing the feasibility of some projects, ODNRI might be required to subcontract with technical personnel.

Mr. Clinton Green, head of the Spices Department, explained that his department is responsible for addressing the marketing requirements of the spice industry, improving the quality of existing spices and developing new spices. The department also sells new marketing techniques.

Mr. Green gave a comprehensive explanation on turmeric, and discussed the sample which Chris Vickery had submitted for analysis. It had been rated higher than average, according to institute standards. Mr. Green also gave Chris a data sheet on the analysis. It was explained that there are two basic types of turmeric; the Alleppey type (which is grown in Swaziland) is a darker and more colorful variety than its cousin, the Madras type. The Alleppey variety is essentially used for color extraction while Madras is used for flavoring by the curry industry.

Mr. Green explained that although Alleppey sells for about 1,100 pounds sterling per ton and the same quantity of Madras is fetches 500 pounds sterling, the Alleppey has a smaller, more specialized and discrete market than the Madras. According to Mr. Green, India is the major producer of Alleppey and production competition is intense.

Because of the competition element in tumeric production, Mr. Green advised the group that an essential characteristic of a product supplier was a good reputation. He encouraged Mr. Vickery to diversify his crops and experiment with other products, such as herbs, and including the Madras variety, since it has a larger market. In addition, he suggested that Swaziland turmeric producers approach turmeric processors such as British

Pepper and Spice Ltd. to request additional information, as these companies have current market research and technology available on turmeric. Chris Vickery had some time to discuss the results of his turmeric samples with the researchers.

The Plant and Food Department is a division of ODNRI which is involved in a variety of centrally-funded work. One area of current research focused on cooking bananas and plantains. Research on mangoes was underway as well. The Fruit and Vegetable section recently conducted a world-wide survey on onions, with specific interest on onion diseases and storage requirements. Mr R.V. Harris, head of the Plant and Food Department, told the group that his department offers two types of assistance or training programs, bilateral and short term. One example of a bilateral program underway is the Caribbean Banana Project, sponsored by ODNRI, in which technical assistance is offered for upgrading banana production as well as strengthening non-banana technology. Short-term courses such as those in Kenya on "Small Scale, Postharvest Processes" are offered as in-country training opportunities. Technical assistance is provided for project identification missions.

Mr. Nigel H. Poulter and Ms. Felicity Proctor from the Fruit and Vegetable Section of ODNRI, met with the group to discuss processing and marketing findings. With regard to processing, Ms. Proctor explained that in Africa, basic, small-scale fruit and vegetable processing is required for domestic and/or regional markets as opposed to the more extensive processing and packaging which is required for exporting to overseas markets. She also said that sun (solar) drying of crops such as mangoes and pineapples might have potential.

Ms. Proctor presented fresh fruit and vegetable marketing concepts to the group, and she emphasized that Europe had a vast market for fresh fruits and vegetables. She was direct in saying that for imported products to be competitive, there must be a process for monitoring pest control and pre-harvest treatment of fruits (such as pruning and insecticide application). The group was told that although the market for fresh vegetables such as beans, peas and asparagus is good in Europe (particularly in France and West Germany), there are also exporting opportunities in other parts of the world. She encouraged the group to contact the Center for more extensive marketing information. Ms. Proctor ended her presentation with guarded advice, warning the group of the competition which will be encountered in the marketplace, high packaging costs and shipping problems which are often encountered when exporting and marketing any fresh product.

Nigel H. Poulter spoke to the group about the department's research on vegetables and explained that although the Fruit and Vegetable Section has a keen interest in cassava, there is currently a buyers migration toward sweet potatoes. He said that current research is focused on finding suitable storage alternatives for cassavas as problems arise in shipping and marketing due to its short shelf life. (See Point 3, page 33, fresh yuca). The section is currently involved in a cassava project for animal feed in South East Asia. In the area of training, it was explained that the Food and Vegetable Section of ODNRI offers a three-month post-harvest course in the UK each year. The curriculum consists of a series of two-week courses designed for specialized skills training.

To end the visit, the group was shown how ODNRI, using computer programs, assesses the peak marketing demand for a product. Chilies were used the example of how a computer can indicate the heat level of a product.

4. ABW Foodstuffs/High Value Horticulture

In the afternoon, at the High Value Horticulture offices, the group met with Mr. Jon Davey of ABW Foodstuffs Ltd., a specialist on the marketing of dehydrated vegetables.

Mr. Davey displayed a variety of dehydrated vegetables purchased from local supermarkets. He explained the general dehydration processes and the specific drying procedures used to produce each end product. He went on to say that major products on the British market depend heavily on dehydrated vegetables, such as tomatoes and onions. According to the attached list distributed by AWB Foodstuffs (see Appendix III), tomatoes are a very important ingredient in many food products, both as spieces and powder, and that tomatoes generally command a very good price.

Mr. Davey also said that the more specialized the product, the more difficult it is to obtain accurate and sufficient market information. However, since dehydrated vegetables are used by both the catering industry and the European working class, there is little danger of market saturation.

Mr. Denzel Phillips, Director of High Value Horticulture, closed the afternoon session by explaining that the company is specifically interested in initiating private sector projects which service both the farmer and the private sector. He stressed that HVH consultants are people who are engaged in the business, i.e. persons with practical hands-on experience, rather than strict academicians. And, he stated, he is looking forward to travelling to Swaziland, which is tentatively scheduled for July, 1990. He emphasized, however, that he would prefer coming to Swaziland when specific work has been assigned for him to do.

D. Washington, D.C.

1. Chemonics/MDI/USAID

W.C. Slocum of Chemonics International Consulting Division and James Bunnell held an early morning meeting with L. Dean Bernius, Deputy Director of the Office of Market Development and Investment (MDI), Bureau of Africa for USAID. The purpose of the meeting was to discuss MDI's very active private sector programs in Africa, and specifically, Swaziland. MDI is planning a large private sector visit to Swaziland, including tour members from several American agribusiness companies. Dean Bernius encouraged the group to use the "commercial approach" when describing and promoting Swaziland to company representatives as it could only enhance possible investment business. (He was assured that we would continue our market driven development approach.)

2. McCormick Spice Company

After this meeting, the group traveled to Hunt Valley, Maryland, to the McCormick Corp. headquarters. Here they were met by Mr. John H. Nelson, Vice President of the Science and Technology Division, Mr. Jon E. Luikaut, Mill Manager, and Mr. Benjamin K. Kaestner, III, Director of Spice Procurement.

Through discussions, the group learned of McCormick's development as a company, its growing pains as its size increased, and its ultimate move to new centralized facilities. The group was taken through the laboratory which was described as the "heart" of the operation. In the laboratory, all products are analyzed for purchase approval or rejected. As the world's #1 spice processor, McCormick purchases all spices through traders and brokers, except for onions and garlic, which are contracted directly with farmers in California. McCormick provides seed, field management and advice, and performs the harvesting.

After initial analysis, products are examined for insect infestation and tested microbiologically. If accepted, the products are then milled and processed to final form and packaged. Some products, such as cloves are milled under a patented cryogenic process. McCormick also has an oleo-resin extraction plant in Singapore where oleo-resins from chilies and turmeric are extracted.

After the laboratory tour, the group went on to see the spice milling operation. The milling processes are very similar to those of a flour mill, even using the same equipment, including the famous Buhler Brothers Mills of Switzerland.

From the mill, the group was taken to McCormick's meeting room where detailed discussions followed. John Nelson was pleased to learn that the samples of Chris Vickery's turmeric had received ratings of 6.1% curcumin, as McCormick acceptance standards range from 5.5%-6.6% curcumin. John Nelson informed the group that the McCormick Company would be happy to receive samples and conduct analyses on other products sent by Chris, and encouraged continued dialogue and contact with Swaziland. It was interesting to learn the Chris Vickery's operation produces more dried turmeric than McCormick sells.

John Nelson and the others thought Chris Vickery's system of washing and preheating the turmeric would give his product an edge over others as it would be less likely to contain microbiological contaminants.

John Nelson said he felt that McCormick must soon find southern hemisphere areas to produce and process onions and garlic. Overseas production would significantly lessen the company's operating capital demands, and compete with high US labor costs.

3. Chemonics International

The group met with the Chemonics International CAPM management staff and specialized subject matter officers, then listened to two outside speakers. Mr. Oral Wheately and Mr. Robert Justis, Jr. Oral Wheately, a representative of a fresh fruits and vegetable marketing agency spoke to the group and explained that his company distributes both locally grown and imported fresh fruits and vegetables. In addition, his agency is involved with consultancy work and food processing; a Lesotho project was used as an example.

Mr. Wheately explained that although it might be difficult for Swaziland to enter the fresh fruit and vegetable market, marketing trials should be undertaken. Europe, particularly France and West Germany, is an excellent potential market for Swaziland as most fresh produce is currently shipped from the Caribbean region.

Chris Vickery mentioned that in the past he has tried to air freight fresh vegetables from Swaziland to European markets, but the main problem he encountered was that there were no Swazi quality control officials to inspect the produce leaving the country. Indeed, product quality control is essential to avoid rejection. It is assumed that the export quality control problem will be resolved in the near future as the Ministry of Commerce and Industry has created a staffed Quality Control Section.

Mr. Wheately also commented that the shipping of fresh produce is a time consuming activity. In the United States, pesticide residues are a serious problem, while in Europe, produce with higher pesticides levels are allowed onto the market. Furthermore, it was explained that although a broker is essential for finding the specialized market niche for large volume exporting, for individuals exporting only small volumes, it is not necessary. However, the broker is added insurance as he/she assumes responsibility for bad debts and other losses from the time he/she takes charge of the products.

The second speaker was Mr. Robert K. Justis, Jr., head of Investment Promotion Service, United Nations Industrial Development Organization (UNIDO). This is a new unit in UNIDO which establishes independent offices in host countries. The field office is not part of the UNIDO Secretariat, but funded by the host government.

The function of the head office, responsible to the US State Department, is to encourage American businesses to locate in developing countries. The Investment Promotion Office is working closely with the World Bank subsidiaries (International Bank of Reconstruction and Development and the International Finance Corporation) and Regional Development Banks (Asian, African and InterAmerican) and agencies, particularly those relating to Africa.

According to Mr. Justis, one of the main means of attracting investment from his side, would be through the use of investment profiles. When a potential investment opportunity in a given country arose, an investment profile would be created describing the economic climate of the country and analyzing the costs and benefits for the investor. Once complete, the profiles would be sent to the Investment Promotion Service office and Mr. Justis would circulate them among potential investors. It was explained to Mr. Justis that investment profiles completed by UNIDO for Swaziland some years ago had had no response from investors. Mr. Justis had no response. Mr. Justis informed the group UNIDO is promoting investment through Regional Meetings designed to bring investors and clients in developing countries together for discussions, but that UNIDO does not have a method of monitoring these kinds of contacts.

UNIDO is also willing to place an appointed officer from a developing country in their office to work on investment promotion. To date, funding for this position has not been secured.

E. Davis, California

1. Food Science and Technology Dept. Univ. of CA/Davis

The group met Dr. Ernest Burton and Dr. Martin Miller of the Food Science and Technology Department of the University of California at Davis. The meeting was arranged to obtain more information on dehydration technology. The discussions included the type of air-flow systems used by the industry and this relationship to product quality, dehydration problems which might be encountered in the drying process, such as case-hardening (the sealing of outer plant tissue which prevents moisture release) and a new drying technique which uses parallel air flow instead of conventional counter-current air flow methods. Also discussed was the impact of legislation regulating purity, additives and contamination levels in dehydrated products. Overall, the professors fully concurred with the dehydration information group members had received from ODNRI in the UK.

The professors distributed detailed drawings of different drying methods, brochures of short courses offered in Food Technology, and a fact sheet on departmental activities and projects. They also provided information published at Central Food Technology Research Institute in Mysore, India, on product drying temperatures for small-scale spice operations. Dr. Martin agreed to send additional dehydration equipment specifications and offered continuing dialogue. He also provided a contact name of Dr. Arno Visser, a Davis graduate currently associated with the South African Dried Fruit Board in Willington, Cape Province.

The professors encouraged the group to visit Northrup-King Seed Company in Woodland and to tour the areas of Iselton and Castroville to observe asparagus and artichoke production.

2. Field Visit - Davis/Woodland Area

Taking the professors' travel advice, the afternoon was spent driving through the Davis/Woodland area looking at the vast rice producing areas as well as maize, wheat, asparagus and tomato fields. It was a bit early in the season to see much production, but field layout and land preparation was noted. At Northrup-King Research Center, the group was provided with brochures and given the sales headquarters contact in Gilroy, California.

3. Beatrice/Hunt-Wesson

The group visited the Davis facility of Beatrice/Hunt-Wesson, home of the world's largest tomato processing company. The group was met by Mr. Robert Beach, Vice President of Industrial Relations, Mr. Kenneth Calhoun, District Manager for, Agricultural Operations, and Mr. Charles Bazinet, Factory

Manager. Mr. Beach travelled from corporate headquarters to meet the Swaziland group.

Hunt processes over one million metric tonnes of tomatoes annually. California, a rich tomato producing area, produces over 7,200,000 mt of tomatoes per year and production estimates for the 1990 harvest forecast an increased yield to over 10,000,000 mt. During 1989, pizza replaced the hamburger as America's No.1 favorite fast food. Even as the major tomato product supplier, Hunt could not provide all the tomato ingredients required by its customers. Today, the Davis facility alone processes 318,000 mt of tomatoes. The basic processing takes place during a period of between 65-72 days. When it was first established, the Davis facility had the most modern tomato processing system designed and today it still maintains that position. The facility provides employment for 1,100 persons on a seasonal basis.

Hunt's tomato production is a good example of a "start-to finish" operation. Production consists of direct seeding, hormone spraying for blossom set and machine harvesting. Field yields are 75 mt/h. (Assuming the fields were hand picked, yields would be well over 100 mt/h). All tomatoes are grown under contract. The contracted price is negotiated annually and for 1990, the price to be paid to the grower will be US$61.87/mt. Average delivery cost (paid by the processor) is US$6.60/ton. Tomatoes are bulk delivered in two bathtub shaped trailers holding 11.4 mt (22.8 mt) each. The grower is contracted to provided a specified tonnage.

The Davis facility has three evaporators for producing tomato concentrate of 31.5% solids. Tomatoes are washed, sorted for quality, crushed and processed. The crushed tomatoes are heated under pressure to a temperature of 121 C, then the heated crushed product is flash cooled to 100 C and the skins and seeds are removed. The liquified product enters the evaporators and through three consecutive stages of increased vacuum, and the product is concentrated to 31.5 percent solids. (Tomatoes are initially 6 percent solids). At this stage, the concentrated tomato pulp is pumped into 32-34,492 liter stainless steel tanks. The product is sterilized and held in storage under a blanket of nitrogen gas. As required, the concentrate is removed from the holding tanks, diluted to a set formula and dispensed into units which are packaged for public sale. Hunt produces tomato juice, tomato sauce, tomato catchup, tomato puree, spaghetti sauce, tomato paste and canned peeled tomatoes.

After a lengthy tour of the factory, the group was taken to a lunch meeting with Mr. Beach, Mr. Calhoun and Mr. Bazinet. Originally, the group had planned to visit three dehydration plants in California: Gentry in Gilroy, Basic Vegetable in King City (formally in Vacaville) and California Vegetable

Concentrates in Modesto. Each of the companies declined the request to visit. In past years these companies would have welcomed visitors but the legal implications of liability with respect to visitor injury etc. have left them little choice but to deny public tour requests. Mr. Beach of Beatrice/Hunt-Wesson explained that Hunt also would have declined the request to visit except for his long standing relationship with the team leader, Jim Bunnell.

4. Field Visit - Yuba City Region

During the later afternoon, the group drove through the Woodland area and viewed rice fields and in the Yuba City region, saw the clingstone peach and plum production areas which were in bloom. Production in most areas was just beginning and it was decided to shorten the visit in central California by one day. The group chose instead to travel from Davis through the Sacramento Delta area, past Stockton to Modesto and Gilroy.

F. Modesto/Los Angeles

This road trip gave group members the opportunity to view California fruit orchards, vegetable production, and livestock feed lots. Crops included peaches, vineyards, nectarines, almonds, English walnuts, spinach, garlic, leeks and onions. Tomatoes had not yet been planted. The group saw a number of fields being prepared, including bed preparation, erosion control, fertilizer application, and leveling and weeding procedures, especially in the vineyards. The group stopped and discussed field preparation and layout where vegetable production was underway.

The systemization and organization of California's agricultural production programme: the California aqueduct, field layout, preparation and maintenance, and production, greatly impressed the group. The quality and technology of what was observed in California is a model to imitate and implement.

Travelling between Modesto and Los Angeles, additional agricultural production was observed. It was too early to see cotton. The large feed-lot near the connection to Fresno was visited.

G. Los Angeles

1. Calpoly

In Los Angeles the group divided into two. One group went to visit the California State Polytechnique University at Pomona (Spencer Dlamini's Alma mater, 1986), and walked through a

variety of universtiy departments. Of special interest was the

Agribusiness section and the opportunity to visit with the Dean of the Department of Agriculture.

2. Chino, Corona, Riverside Tour

The second group toured the intensive dairy area of Chino and then on to see orange and lemon production in the Corona and Riverside regions. In Orange County, specialized and intensive production of strawberries, sweet corn and tomatoes was observed.

H. Miami

1. Tropical Research and Education Center

The group visited the Tropical Research and Education Center at the University of Florida in Homestead. The group was met by Drs. Herbert Bryan, Vegetable Horticulturalist and R.T. McMillan, Jr., Associate Plant Pathologist.

Florida has a US$5 billion annual agriculture output from 100,000 acres of production. The Research Center works directly with the commercial sector in research, extension and education. The fruits and vegetables cultivated by the station and seen by the group included: guava, mamey, papaya, cherimoya, passion fruit, (yellow, purple and red) atamoya, carambolo, acerola (barbados cherry), mangoes, avocados, limes, nezperos, ginger, coconuts, kumquats, logans, lychees, sapotes, sweetcorn, tomatoes, green beans (bush and pole), okra, cabbage, melange, chyote, potatoes, yucca (cassava), and breadfruit. New programmes will include other Southeast Asian tropical fruits such as durian and jackfruit. Mangosteen does not thrive in Florida due to the winter frost.

The research station is conducting extensive research and demonstrations with mulching and the use of organic material in trenches. The soil around Homestead is solid calcium carbonate and before any planting is even considered, the land must first be shaved by a special blade attached to a crawler tractor. The process removes 2.54 cm of calcium per shave, and at least 15 cm. of the calcium must be crushed before planting. The crushed calcium carbonate is then further reduced in size by special ploughing techniques. Only after completing this process can planting take place. Heavy fertilizer application is required and root depth is shallow. The idea of "trenching" prepares rows which are 25-30 cm deep to allow deeper root growth. The water table is 1m to 1.5m, and much of the irrigation is done by penetrating the calcium layer and preparing a sump. Fields are watered by portable pumps with pivots which are mounted on trunks which can irrigate 1 square hectare at a time. Water loss is high (up to 70%) due to wind and warm temperatures, but water is plentiful, and the main cost is energy.

Land preparation for fruit is usually one of two types: trees planted in cross trenching, or more frequently, in mounded soil in rows. The latter method provides improved drainage because of the high water table. Fruit trees are drip irrigated. Most orchards have both overhead and ground level sprinklers, for protection during frost season, when warm water (21 C) is sprayed on the trees.

A most interesting point of agriculture production in the Homestead area is that it takes place on artificially created soil. Only through specialized preparation of otherwise unusable hardpan and with specially formulated inputs (such as fertilizer) and cultural practices, can production be achieved on a quality and economically viable level.

It is also interesting to note, that while California agriculture production is generally on large area holdings, fruit and vegetable production in the Homestead area of Florida is frequently from small units, usually between 1.2-3h. Some units are larger and the group saw many units of between 5h-15h. The Center encourages persons living on .5-1h home sites to plant fruit trees as packers and shippers will buy fruit grown on any size unit and small units can use the income to pay property and other taxes from sale of their fruit.

The area produces 20 commercial varieties of avocados but many of these are being replaced by other fruit which have higher market value.

The two types of guavas under production at the university are the white and pink varieties, with pink being the variety which is more widely grown. Fruit size is large, up to 7 cm in diameter. Most guavas are sold on the fresh market, but a large percentage is also processed for the Latin American market in the form of nectar, halved and canned fruit in syrup (cascos), guava jelly and a guava paste. Guava production season is from July through March.

The Center advised that guava trees be pruned to no higher than 2.13m, with limbs along the rows squared, to allow for the fruit to be picked from the ground. Lime trees should be similarly pruned, but avocados and mangoes should be topped at between 4.5m-6m.

2. Field Visit - Packing Sheds

In addition to spending part of the day at the Research Center's field trial areas and visiting commercial production units for tomatoes, okra, cucumbers and zuccini, the group also had the opportunity to visit a small scale guava packing shed and the JR Brooks Company, the largest packer and shipper of tropical fruits and vegetables in the US. The small packing shed was the

type which would be appropriate for use in Swaziland. The building had a roof, was open on the sides and had movable tables for grading, sorting and boxing of produce. It also had a cold storage room.

The J.R. Brooks operation, in contrast, was large, automated and computerized. There was one section dedicated to limes and avocados alone, and another section was used for packing all other products. Avocados are hydro-chilled before being packed and stored, and this facility had a cold storage capacity of at least 500 mt.

3. Extension Center

Included in the Homestead visit a trip was to the Extension Center where the group was given bulletins from the publications list. Miscellaneous facts of interest:

1) Anthracnose in mangoes can be controlled by benolate and prochoraz but is not sold in the USA;

2) In an experiment, 32h of carambola was surrounded by plastic webbing formed a wind break. This is expensive, but at 8 years, these trees were each yielding 4mt of fruit per year. Market value is currently is US$1,100/mt;

3) The shelf life of fresh yucca (cassava) can be increased by coating it in hot wax prior to shipping;

4) Guava is propagated by aerlaying;

5) The Center is involved in research on biodegradable plastic.

6) Technology is constantly being developed to mazimize agriculture production.

III. Implications for CAPM

The activities which result from this observation tour will be the responsibilities of the individual participants. It is expected that each, within his/her own area of development interests and expertise will take initiatives share with collegues, pertainant information which was learned on the trip.

One effort already underway is the initial production trial for the special variety of onion used in dehydration. Through the courtesy of Dr. John Nelson of McCormick, CAPM has received five samples of onion seed which is to be tested in five different zones of potential production in Swaziland. The

production will be professionally monitored with regard to performance and test dehydrated at Mr. Vickery's operation. Others cooperating in this project are MOAC Crop Production Unit in Manzini, MOAC Research at Malkerns, and small farmer production associations selected by MOAC Crop Productions.

The Vickery tumeric dehydration unit at Malkerns is currently undergoing major modification, based on designs acquired on the observation tour. The facility is expected to be complete in time to accommodate the 1990 harvest and will be used to carry out drying trials with new products.

APPENDIX I

ITINERARY FOR DEHYDRATION OBSERVATION TOUR

Date	Meeting Place
10 March	Mbabane, Manzini, Johannesburg
11/12 March	**London**
	High Value Horticulture, Uxbridge Briefing on dehydration. Discussion dehydration equipment
	Lunch
	Neu Engineering, Working, Surrey
13 March	**London**
	High Value Horticulture, Uxbridge Briefing on dehydrated products
	Lunch
	ODNRI, Chatham, Kent
14 March	**London/Washington, D.C.**
	London/Washington, D.C.
15 March	**Washington, D.C.**
	Meeting with Dean Bernius at MDI
	Mccormick and Company (Main office)
	Cocktails/Dinner at the home of Candace Conrad.
	Chemonics
16 March	Welcome and orientation Lunch Chemonics videos - topics: Soil erosion Seed certification. St. Patrick's day happy hour (office celebration)
17 March	Individual sightseeing
18 March	Group departs for San Francisco

19 March	UC-Davis - UC-Davis Food Science and Technology Department
20 March	Visit to Hunt/Beatrice-Wesson
21 March	Site Visit (Modesto area)
22 March	Site Visit (Gilroy area)
23 March	Site Visit (San Joaquin Valley-West area)
24 March	Los Angeles - free day (California Polytechnical University - Pomona)
25 March	Travel from Los Angeles to Miami
26/27 March	Visit to University of Florida Tropical Research and Education Center, Homestead, Florida
28 March	Group departs Miami Group departs New York
29 March	Group departs London
30 March	Return to Johannesburg and Manzini

APPENDIX II

CONTACT PERSONS IN UK AND US

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Mr. John Nabney Mr. R.V. Harris Mr. Nigel H. Poulter Ms Fecility Proctor Mr. Michael J. Milchard Mr. Alan Mater Mr. Clinton Green	Deputy Director, Food Science & Crop Utilization Head of Plant & Food Department Researcher, Fruit & Vegetable Department Researcher, Fruit & Vegetable Department Researcher Economist, Department of Econ. & Soc. Statistics Head of Spice Department ODNRI, Central Avenue Catham Maritime Catham Kent ME4 4TB United Kingdom Tel: 0634-880088 Fax: 0634-880066/77
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Mr. R.T. McMillan, Jr Mr. Herbert Bryan	Associate Plant Pathologist Vegetable Horticulturist Tropical Research and Education Center 18905 SW 180th Street Homestead, FL 33031 Tel: 305-246-6340
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APPENDIX III

EUROPEAN PRICE RANGE - DEHYDRATED VEGETABLES - TRADE SOURCE, 1990
(Delivered to Northern Europe and UK in full container loads)

Carrots - standard cuts (10 mm x 10 mm x 10 mm)	US$1500-1750 mt
Carrots - special cuts (thin enough to hydrate in 1 min)	1750-2600 mt
Peppers - red & green (10 mm x 10 mm x 2 mm) (15 mm x 15 mm x 2mm)	3000-6000 mt
Tomato pieces - 125 mt	4000-6000 mt
Tomato powder-spray dried - 1000 mt	4600-4800 mt
Spinach powder	1500-2000 mt
Beetroot powder	1350-1500 mt
Leek flakes green	1.650-1.800mt
Onion white flakes	2000-2500 mt
Garlic, chips	1,000 mt
powdered	3,000 mt
Mushroom (sliced, button)	10,000-20,000 mt
Porcini mushroom	30,000-60,000 mt
Chives, sliced	8,000 mt
whole	20,000 mt
Parsley, curley	2.06/kg
flat	2.06/kg
Oregano	2.50/kg
Basil	2.50/kg
Tarragon	2.40/kg
Sage-rubbed	1.72/kg
Marjorum	2.50/kg
Rosemary, cut needles	3.10/kg
Mint	3.14/kg
Celery leaf	1.37/kg
Celery root	1.37/kg

APPENDIX IV

MCCORMICK RAW MATERIALS SPECIFICATIONS

Whole Alleppey turmeric 600249/610068

I. Product Profile: Dried, irregular and branched rhizome of the perennial tropical herb Curcuma longa L.

II. Physical Requirements:

Color : Brownish-orange
Aroma : Earthy
Taste : Pungent, slightly bitter
Visual: Must match standard in terms of sticks, stems, chaff, hair, color and extraneous matter.

III. Analytical Requirements

Volatile Oil: N/A Color Power: 5.0 to 6.6.% Curcumin
Moisture: 9.0% Maximim

IV. Cleanliness Specifications:

Insect Fragments:	75/25 gms
Striated Animal Hair:	2/25 gms
Whole Insects (microscopic): (mostly field source)	5/25 gms

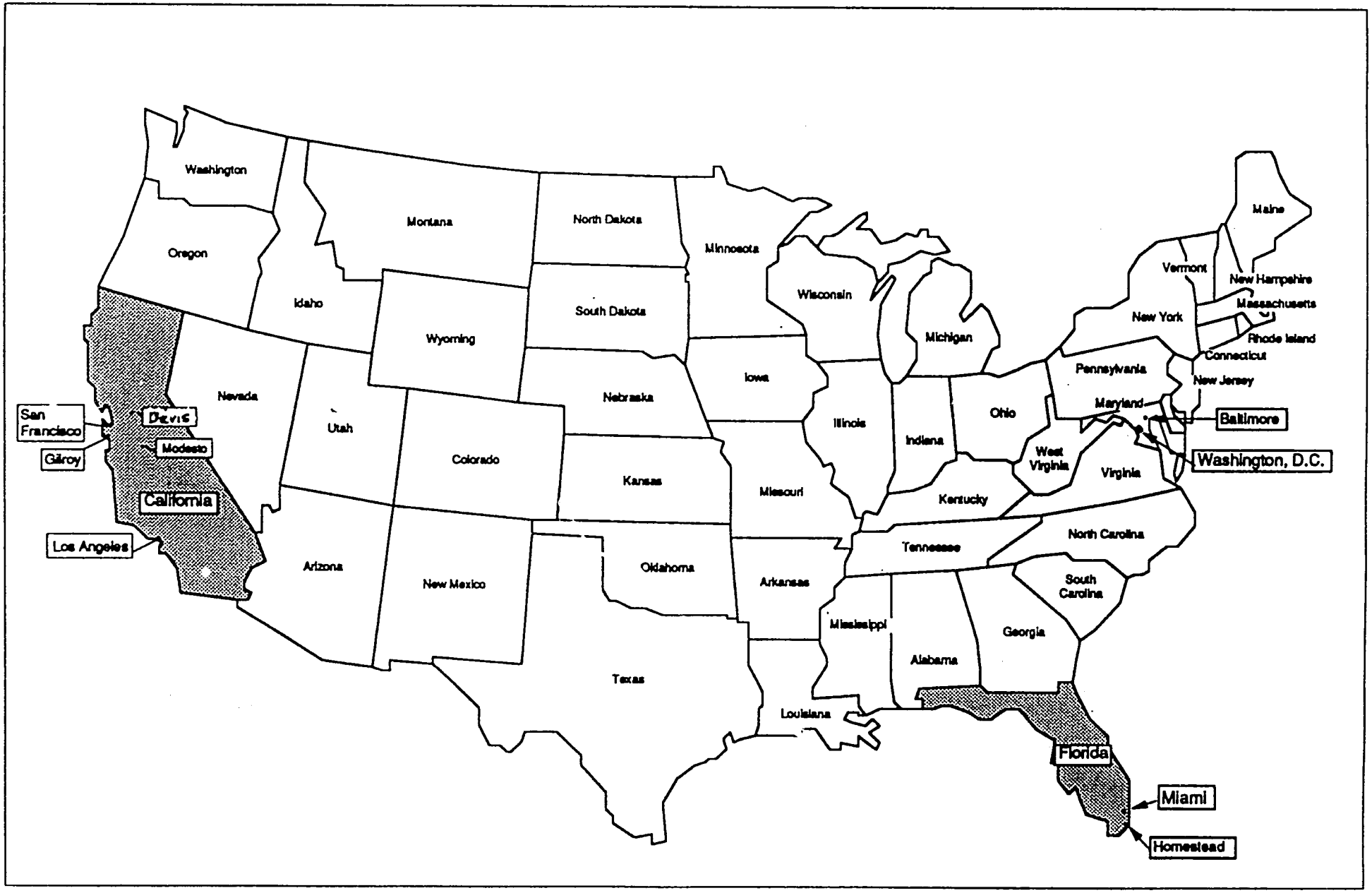
V. ASTA Standards: Using ASTA Methods (March 1982)

Whole Insects (macroscopic) :	3 by count
Excreta, Rodent:	2 by count
Excreta, Other:	5.0 mg./lb
Mold:	3.0% by weight
Insect Defiled:	2.5% by weight
*Extraneous Matter:	0.50% by weight

*Extraneous matter is defined as everything foreign to the product itself and includes, but is not restricted to: stones, dirt, wire, string, stems, sticks, non-toxic foreign seeds, excreta, manure and animal contamination.

Approvals

Supervisor, Specifications, GPD
Director, Technical Services, GPD
Manager, Technical Services, SMD



Swaziland CAPM Dehydration Tour Sites, March 15- 28, 1990